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Solvent Permits Solid Curing Agents to be Used at Room Temperatures

The problem:

To determine the feasibility of using a solvent system for dissolving the solid curing agents used with polyurethane resins in adhesive systems. The bonds formed must be as strong, or nearly as strong, as in the prior method which used melted solid curing agents. This process was difficult to use in assembly line operations because of the necessity of melting the curing agent before it could be mixed with the base resin.

The solution:

Two polyurethane two-component adhesive pastes used in cryogenic bonding, each consisting of a solid adhesive curing agent and a resin were tested. The solid curing agents are normally melted at 250°F prior to mixing with the polyurethane resins.

The various solvents evaluated included: tetrahydrofuran, acetone, dimethyl formamide, and mesityl oxide. In the case of each solvent, the solid curing agent was stirred in until a saturation solution was formed. The resulting dispersed solvent was mixed with the applicable polyurethane resin until the mixture was homogeneous. Entrapped air and as much solvent as possible were then removed.

The various resin mixtures were applied to aluminum panels, which were then assembled for bond testing. The panels were allowed to cure for a minimum of 3 days at 2 to 3 psi pressure. The assembled panels were shear tested in a tensile testing machine at various temperatures between -423°F and 250°F. The bonds were also tested for thermal shock cycling and sustained exposure in liquid hydrogen.

A solvent dispersion system was developed which yielded bond strengths comparable to 100 percent solid formulations. The optimum solvent chosen was a 55.5 percent solution in anhydrous tetrahydrofuran. A saturated solution containing the curing agent was mixed in the ratio of 11:100 with the applicable base resin.

Notes:

1. The solvents used were mainly nonreactive diluents and as such extended pot life without appreciably increasing the set time. Tetrahydrofuran had the least detrimental effect on the mechanical properties of the cured adhesive.
2. The maximum amount of solvent must be removed from the resin mixture before the parts are assembled, making degassing and an extended open time essential.
3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B67-10593

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: M. C. St. Cyr
of Douglas Aircraft Company
under contract to
Marshall Space Flight Center
(MFS-13434)

Category 03

1918 IN THE AIR

1918 was a year of great change in the world. The First World War had ended, and the United States had entered the League of Nations. The Spanish Flu pandemic had spread across the globe, killing millions of people. The United States had become a major player in world affairs, and the economy had boomed.

The year began with the signing of the Treaty of Versailles, which officially ended World War I.

In January, the United States became the first country to ban the sale of alcohol. This was part of the禁酒令 (Prohibition), which aimed to reduce alcohol consumption and combat social problems like poverty and crime.

On March 4, Woodrow Wilson was inaugurated as the 28th President of the United States. He focused on foreign policy, particularly the promotion of democracy and international cooperation. He also supported the League of Nations, which he believed would help prevent future wars.

On April 6, the United States declared war on Germany, marking the entry of the United States into World War I. The war had been fought between the Central Powers (Germany, Austria-Hungary, Bulgaria, and Turkey) and the协约国 (Russia, France, Britain, Italy, and others).

On June 28, Archduke Franz Ferdinand of Austria was assassinated by Gavrilo Princip, a member of the Black Hand secret society. This event triggered the start of World War I.

On August 14, the United States declared war on the Ottoman Empire. This brought the total number of countries involved in the war to 30. The United States' entry into the war was seen as a turning point, as it provided much-needed resources and manpower to the协约国.

On November 11, 1918,

the Armistice of Compiègne was signed, marking the end of World War I. The war had lasted four years and cost millions of lives. The United States had played a significant role in the final stages of the war, particularly in the Battle of the Somme and the Meuse-Argonne Offensive.

On December 8, the United States became the first country to ratify the Treaty of Versailles, which officially ended World War I.

On January 1, 1919, the League of Nations was established. It was a global organization that aimed to promote international cooperation and prevent future wars. The United States was one of the original members, along with Britain, France, and others.

On February 28, 1919, the United States became the first country to ratify the Treaty of Versailles, which officially ended World War I. The war had lasted four years and cost millions of lives. The United States had played a significant role in the final stages of the war, particularly in the Battle of the Somme and the Meuse-Argonne Offensive.

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